



**CONESTOGA-ROVERS
& ASSOCIATES**

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DRAFT MEMORANDUM

TO: Michael Berkoff REF. NO.: 056393-70

FROM: Aaron Stadnyk/Rick Hoekstra/cs/8 DATE: September 2, 2010

CC: Richard Gay (Weyerhaeuser); Kristi Zakrzewski (MDNRE);
Jeff Keiser(CH2MHill); Scott Hutsell(CH2MHill);
Grant Koster(CH2MHill); Greg Carli (CRA)

RE: Status Update - Leachate Extraction Well/Leachate Production
12th Street Landfill - Operable Unit No. 4 - Allied Paper/Portage Creek/Kalamazoo River
Superfund Site; Plainwell, Michigan

A. INTRODUCTION

The following memorandum has been prepared by Conestoga-Rovers & Associates (CRA), on behalf of Weyerhaeuser Company (Weyerhaeuser), to provide a status update on the leachate extraction well and leachate collection activities that have been conducted at the 12th Landfill Site Operable Unit No. 4 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site).

As part of the remedial activities conducted at the Site, CRA installed four temporary leachate extraction wells for the purpose of investigating and removing the potential perched leachate in areas of the landfill that historically received construction debris. The leachate extraction wells were installed in lieu of the specified test pits required in Section 6.3.2 of the Final Design Report for the Site.

The four temporary leachate extraction wells were installed within the identified locations of construction debris, and near the top of the current northwest and southeast side slopes, upgradient of observed leachate seeps emanating from these two side slope areas. Slope excavation activities have been completed around to the west side of the landfill, adjacent to the asphalt plant property, and no further construction debris was observed, nor have any additional seeps been identified.

B. LEACHATE EXTRACTION/COLLECTION ACTIVITIES

The temporary leachate extraction wells (LEW-1 through LEW-4, as shown on Figure 1), were installed to a depth ranging between 15 and 22 feet below ground surface (bgs), with the depths being based on observed subsurface soil conditions. Each leachate well was installed and screened at a depth interval observed to be saturated during the borehole advancement, as shown in the stratigraphic logs included in Attachment A.

Following the installation of the four temporary extraction wells, each well was pumped at various times between August 2, 2010 and August 30, 2010 and is still ongoing. During the pumping activities, both the hydraulic water levels and the daily quantity of leachate removed were recorded. At the commencement of

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ISO 9001
ENGINEERING DESIGN

the pumping activities initial water levels indicated the presence of leachate at three of the four extraction wells (LEW-1, LEW-3, and LEW-4). LEW-2 was determined to be dry, although during the installation of the well, the subsurface soil conditions were noted as being saturated. LEW-2 was inspected daily for the presence of water throughout the pumping activities and continued to remain dry.

Pumping activities commenced at the three active leachate extraction wells. During the ongoing pumping activities, water levels at the locations were regularly measured. Based on the hydraulic water level data, no appreciable influence or hydraulic conductivity between wells was observed.

To date, a total of approximately 1,300 gallons of leachate has been removed (as shown in Table 1), treated on-Site at the temporary water treatment facility and shipped off-Site to the City of Plainwell Water Renewal Plant.

During the first week of pumping activities the recharge rate at each active leachate extraction well was not determined, however the total quantity of leachate removed from each well has been noticeably decreasing. During the pumping activities conducted between August 18, 2010 and August 30, 2010, the approximate rates of recharge at each of the three active extraction wells were determined, as discussed below.

LEW-1:

Between August 2, 2010 and August 16, 2010, leachate was extracted from LEW-1 for a total of six days. Each day during this period, LEW-1 was pumped for approximately four hours, generating an average of approximately 45 gallons each day for a total of approximately 275 gallons for the first six days. The daily rate of leachate generation at LEW-1 gradually increased each day during this period, however, this is assumed to be related to well maintenance that was conducted at LEW-1 and initial development and clearing of the well screen.

Between August 17, 2010 and August 30, 2010, LEW-1 was pumped for a total of four days. During each day, LEW-1 was pumped for approximately 1.5 hours, initially generating approximately 35 gallons per day and gradually decreasing to approximately 10 gallons per day, for a total of 85 gallons collected during the course of the four days. The time required for LEW-1 to recharge after each pumping event increased during this period of time. Initially, this well recharged in approximately 2 hours, but following this four days of pumping, the recharge time at LEW-1 increased to approximately 8.0 hours.

LEW-3:

Between August 2, 2010 and August 16, 2010, leachate was extracted from LEW-3 for a total of six days. Each day during this period, LEW-3 was pumped for approximately four hours, generating an average of approximately 55 gallons each day for a total of approximately 275 gallons for the first six days. The quantity of leachate extracted each day at LEW-3 fluctuated throughout the first three days of pumping, generating between 40 and 80 gallons per day. By the end of the six day pumping period, the average quantity of leachate extracted was approximately 40 gallons per day.

Between August 17, 2010 and August 30, 2010, LEW-3 was pumped for a total of eight days. LEW-3 was pumped for approximately 1.5 hours per day, generating approximately 10 to 15 gallons per day, for a total of approximately 85 gallons during the course of the eight days of pumping. The time required for LEW-3 to recharge after each pumping event increased during this period of time. Initially, the well recharged in approximately 3.0 hours, but following this eight days of pumping, the recharge time at LEW-3 increased to

approximately 6.0 hours. It should be noted that the level of leachate at LEW-3 did not recover entirely to the initial elevation prior to pumping.

LEW-4:

Between August 2, 2010 and August 16, 2010, leachate was extracted from LEW-4 for a total of six days. Each day during this period, LEW-4 was pumped for approximately four hours, generating approximately 31 gallons each day for a total of approximately 185 gallons for the first six days. The daily rate of leachate generation at LEW-4 remained relatively constant during this pumping period.

Between August 17, 2010 and August 30, 2010, LEW-4 was pumped for a total of six days. LEW-4 was pumped for approximately 1.5 hours each day, generating approximately 50 gallons per day, for a total of approximately 300 gallons during the course of the six days. The time required for LEW-4 to recharge after each pumping event fluctuated, however increased during this period of time. Initially, the well recharged in approximately 1 hour, but following this six days of pumping, the recharge time at LEW-4 increased to approximately 7.0 hours, with noted fluctuations. It should be noted that the level of leachate at LEW-4 also did not recover entirely to the initial elevation prior to pumping.

C. SITE OBSERVATIONS - LEACHATE SEEP CHARACTERISTICS

During the course of the pumping activities between August 2, 2010 and August 30, 2010, observed seeps in the vicinity of the leachate extraction wells, along the northwest and southeast side slopes, were inspected daily as part of the pumping activities.

Prior to the start of pumping activities, the leachate seep along the northwest side slope of the landfill appeared to have some appreciable generation and noticeable flow. Immediately following rain events, this seep was observed to trickle and flow down the northwest side slope of the landfill. At no time was the leachate emanating from this northwestern seep a concern, as leachate did not migrate off-Site or cause appreciable erosion issues requiring regrading of the slope or the installation of additional soil erosion and sedimentation controls.

The leachate seep along the southeast side slope was observed to have very minimal flow or leachate generation. The leachate emanating from this seep appeared to trickle immediately following rain events. At no time was the southeastern seep a cause for concern, as the leachate emanating from the seep ceased a few feet downgradient and did not migrate off-Site.

In general, during the active pumping activities, leachate seeps have been observed to decrease in overall size and the quantity of leachate emanating from each seep has also visually decreased. The northwest leachate seep has been bisected by LEW-4. The portion of the northwest seep to the north of LEW-4 has virtually dried up and virtually no observable leachate is emanating from this portion. The remaining portion to the south of LEW-4 does have some residual flow. This active portion of the northwest seep will be addressed with an interim action discussed in Section D.

Similarly, residual leachate has been observed to be emanating from the southeast leachate seep. The overall length of the seep has decreased; however along the southern end of the seep, leachate is still observed to be seeping and pooling on the southeast side slope of the landfill. It should be noted that virtually no visual flow is observed at the southeast seep, but the presence of leachate is observable.

D. INTERIM RESPONSE ACTIONS - LEACHATE EXTRACTION TRENCHES

To address the residual leachate emanating from the northwest and southeast side slopes, CRA will immediately implement an interim action at each seep location to address leachate. Based on visual observations, small leachate extraction trenches will be excavated directly upgradient of the observed leachate seeps. The extraction trenches will run along the lateral extent of each seep. Each trench will be approximately 2 to 3 feet in depth and 2 feet in width. The base of the trenches will be sloped in order to direct leachate to a low point or sump to be installed within each trench. The excavated material will be staged directly upslope of the trench, in order to prevent potential storm water from entering the trench.

Leachate will be collected from each trench at various times during September 1 through September 3, 2010. A photographic log will be prepared to document the interim actions and progress of leachate extraction. On September 3, 2010, the extraction trenches will be backfill and compacted in preparation for construction of the landfill cover system.

E. SLOPE STABILITY/UPLIFT ASSESSMENT

The stability of the final design of the landfill was based on standard modeling methods using a number of conservative assumptions (included as Appendix B of the Final Design Report). The modeling evaluated both the global stability of the landfill and the factor of safety against a catastrophic slope failure, and the stability of the cover system and the factor of safety against liner system failure. CRA has reviewed the modeling assumptions in comparison to the observed conditions at the landfill and in general, the current condition of the leachate in the landfill is more favorable than the modeled conditions and therefore the presence of leachate in the landfill, whether the leachate is perched or mounded, does not pose a slope stability concern as discussed in the following paragraphs.

Global stability of the landfill was evaluated by assessing the slope stability along several sections of the landfill. As part of this evaluation, the condition where the landfill was assumed to be fully saturated was evaluated and determined to have an acceptable factor of safety against failure. The current leachate levels observed at the Site show that the landfill is in a condition which is substantially less than fully saturated, which would represent a more favorable condition than the assumed fully saturated condition. Therefore, global stability of the landfill is not a concern with respect to the observed leachate levels (i.e., if the global slope stability model was to be re-run using the current leachate levels the factor of safety against failure would be higher than what was presented in the Final Design Report).

The stability of the final cover system was evaluated by assuming an uplift pressure on the landfill liner of two inches (i.e., the level of leachate in the landfill is such that it is causing two inches of upward pressure on the under side of the liner). The minimum factor of safety against failure determined in the cover stability evaluation for this condition was 3.5 (i.e., the upward pressure on the liner would need to be significantly greater than two inches to get to a factor of safety which may have the potential to result in a slope failure condition). The observed quantity of leachate emanating from the visible leachate seeps is minimal in comparison with the final design assumptions for upward pressure, and may cause a slight pressure on the liner if the liner were to be placed directly on the paper residuals. However, the six inch sand layer, which will be placed between the paper residuals and the liner, will provide relief of any pressure caused by the leachate preventing any uplift pressure to form beneath the liner, and minimize, if

not virtually eliminate the accumulation of leachate. In addition, the small amount of observed leachate in the current leachate seeps suggest that the six inch sand layer would still be entirely available for gas venting, as the observed quantity of leachate within the seeps would not block or saturate this sand layer.

F. CONCLUSIONS AND RECOMMENDATIONS

Based on current Site conditions and the information generated from the leachate collection activities, the leachate presence within the landfill does not impact or change the original design and the slope stability evaluation of the landfill, for the following reasons:

- 1) The leachate present at the landfill appears to be more representative of a groundwater mound within the landfill rather than "perched" groundwater present in isolated locations based on the observed leachate removal and recovery rates and the relatively consistent locations of the seeps that have been observed. In addition, although the overall leachate level within the landfill has not been significantly reduced as a result of the extraction activities, the removal activities that have been completed have reduced the amount and quantity of seeps present. The additional leachate collection activities proposed in the interim response actions (Section D) will further reduce the leachate quantity present.
- 2) As stated in the Final Design, even if the groundwater mound were much more significant than what has been observed (i.e., fully saturated), the factor of safety against global slope failure is acceptable. Moreover, following the installation of the landfill cover system, the groundwater mound will decrease, further improving the groundwater conditions beneath the Site.
- 3) The ongoing presence and quantity of leachate emanating from the current seeps at the Site will not impact global or slope stability of the landfill. Following the installation of the landfill cover system, residual leachate emanating from the landfill will be able to percolate along the landfill slopes via the six inch gas venting layer, but will not impact the performance of the sand layer.

TABLE 1
DAILY QUANTITY OF LEACHATE COLLECTION
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO SUPERFUND SITE
PLAINWELL, MICHIGAN

Date	Daily Leachate Extraction (US Gallons)			Daily Subtotal
	LEW-1	LEW-3	LEW-4	
8/2/2010	6	-	-	6
8/3/2010	65	45	50	160
8/4/2010	12	15	65	92
8/5/2010	93	87	-	180
8/10/2010	100	86	30	216
8/16/2010	-	40	40	80
8/18/2010	-	-	40	40
8/19/2010	-	10	50	60
8/20/2010	-	10	-	10
8/23/2010	-	15	50	65
8/24/2010	35	-	-	35
8/25/2010	30	25	40	95
8/26/2010	10	10	80	100
8/30/2010	10	15	50	75
8/31/2010	15	15	50	80
Subtotal	376	373	545	
Total Leachate Collected:				1294

Notes:

"-" - No value available.

TABLE 2

**LEW-1 HYDRAULIC MONITORING DATA
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
PLAINWELL, MICHIGAN**

Date	Time	Water Level (ft bgs)	Pump Status	Recharge Time (hh:mm)
8/24/2010	10:51	14.96	Off	
	11:02	24.53	On	
	11:15	24.59	On	
	13:31	21.21	On	
	13:36	24.55	On	
	16:15	24.59	On	
	16:21	24.02	Off	
	18:27	19.98	Off	2:12
8/25/2010	9:09	15.03	Off	
	11:35	15.02	Off	
	12:51	15.02	Off	
	13:34	24.50	On	
	14:42	24.58	On	
	14:51	23.50	On	
	15:11	22.83	Off	
	16:24	20.41	Off	
	16:45	19.82	Off	
	17:39	18.41	Off	
	18:37	17.04	Off	3:55
8/26/2010	8:25	15.05	Off	
	9:30	24.05	On	
	12:14	17.68	Off	
	13:34	16.18	Off	
	20:17	15.15	Off	8:03
8/30/2010	9:02	15.13	Off	
	9:21	24.58	On	
	10:43	24.57	On	
	10:48	24.19	Off	
	11:04	23.25	Off	
	12:51	20.31	Off	
	13:59	18.74	Off	
	15:38	16.72	Off	
	16:43	15.95	Off	
	17:20	15.85	Off	7:59

TABLE 3

LEW-3 HYDRAULIC MONITORING DATA
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
PLAINWELL, MICHIGAN

Date	Time	Water Level (ft bgs)	Pump Status	Recharge Time (hh:mm)
8/19/2010	9:03	11.11	Off	
	9:42	11.05	Off	
	12:02	11.06	Off	
	13:40	11.09	Off	
	15:36	11.06	Off	
	15:56	19.80	On	
	16:09	19.81	On	
	19:50	11:57	Off	3:41
8/23/2010	8:08	11.15	On	
	9:53	11.18	Off	
	11:08	11.18	Off	
	13:26	11.13	Off	
	13:42	19.75	On	
	13:51	19.83	On	
	15:03	19.85	On	
	16:53	18.69	Off	
	17:08	18.12	Off	
	18:03	16.59	Off	
	18:49	15.45	Off	3:46
8/25/2010	9:15	11.16	Off	
	11:38	11.19	Off	
	11:44	18.01	On	
	12:45	19.96	On	
	13:07	18.59	Off	
	13:40	16.93	Off	
	14:31	15.50	Off	
	14:54	14.55	Off	
	15:14	14.08	Off	
	16:17	12.73	Off	
	16:47	12.11	Off	
	17:37	11:48	Off	
	18:35	11.41	Off	5:28

TABLE 3

LEW-3 HYDRAULIC MONITORING DATA
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
PLAINWELL, MICHIGAN

Date	Time	Water Level (ft bgs)	Pump Status	Recharge Time (hh:mm)
8/26/2010	8:20	11.25	Off	
	9:35	11.30	Off	
	10:35	20.00	On	
	12:07	15.16	Off	
	13:30	13.53	Off	
	16:15	11.38	Off	5:40
8/30/2010	9:00	11.23	Off	
	10:57	11.24	Off	
	11:01	19.38	On	
	12:48	19.96	On	
	12:53	18.73	Off	
	13:57	16.86	Off	
	15:29	15.12	Off	
	16:40	13.99	Off	
	17:18	13.45	Off	4:30
8/31/2010	8:23	11.26	Off	
	10:45	11.24	Off	
	10:50	19.80	On	
	11:24	19.95	On	
	11:51	19.84	Off	
	12:00	18.45	Off	
	13:24	15.83	Off	
	16:14	13.13	Off	
	17:31	12.19	Off	5:40

TABLE 4

**LEW-4 HYDRAULIC MONITORING DATA
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
PLAINWELL, MICHIGAN**

Date	Time	Water Level (ft bgs)	Pump Status	Recharge Time (hh:mm)
8/18/2010	13:31	8.09	On	
	15:48	19.35	On	
	15:56	17.20	Off	
	16:00	15.20	Off	
	16:13	12.48	Off	
	17:00	8.82	Off	1:12
8/19/2010	9:12	8.07	On	
	9:30	18.10	On	
	10:07	17.50	On	
	11:51	19.98	On	
	12:05	15.29	Off	
	13:49	8.59	Off	
	15:43	8.21	Off	
	16:06	8.19	Off	6:36
8/23/2010	8:10	7.94	On	
	9:38	18.00	On	
	9:48	19.80	On	
	11:13	19.97	On	
	11:52	19.98	On	
	12:08	15.60	Off	
	13:34	8.50	Off	
	13:53	8.36	Off	
	15:09	8.14	Off	
	16:59	8.03	Off	5:07
8/25/2010	9:05	8.02	On	
	9:22	19.80	On	
	10:13	20.02	On	
	10:19	17.60	Off	
	11:16	8.86	Off	
	11:31	8.65	Off	
	12:48	8.24	Off	
	13:37	8.18	Off	
	14:37	8.15	Off	
	15:02	8.11	Off	4:49

TABLE 4

**LEW-4 HYDRAULIC MONITORING DATA
12TH STREET LANDFILL SITE
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
PLAINWELL, MICHIGAN**

Date	Time	Water Level (ft bgs)	Pump Status	Recharge Time (hh:mm)
8/30/2010	9:06	8.31	Off	
	10:54	8.28	Off	
	14:05	8.21	Off	
	14:09	20.05	On	
	15:33	20.05	Off	
	15:45	19.10	Off	
	16:46	9.09	Off	
	17:23	8.65	Off	3:14
8/31/2010	8:30	8.20	Off	
	8:36	20.02	On	
	9:51	20.04	Off	
	10:00	17.10	Off	
	10:11	13.72	Off	
	10:53	9.27	Off	
	11:18	8.85	Off	
	11:55	8.56	Off	
	13:26	8.34	Off	
	15:44	8.24	Off	
	17:28	8.19	Off	7:37

ATTACHMENT A

FIELD BORING LOGS

STRATIGRAPHY LOG (OVERBURDEN)

PAGE 1 OF 4

PROJECT NAME 12th Street Landfill
PROJECT NUMBER 056393
CLIENT Weyerhaeuser
LOCATION Oshtemo, MI

DRILLING CONTRACTOR EDAC
DRILLER Shaun
SURFACE ELEVATION _____
WEATHER (A.M.) _____
(P.M.) _____

HOLE DESIGNATION extrusion well #1
DATE/TIME STARTED 7/26/10
DATE/TIME COMPLETED _____
DRILLING METHOD Auger - 6" 1/4" BH
CRA SUPERVISOR Robandy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).	S A M P L E #	S A M P L E L T H I N G D	SAMPLE DETAILS						S I N T E R V A L	P I D F I D (ppm)	C H E M I C A L	A N A L Y S I S	G R A I N S I Z E
F R O M	A T	T O				PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)										
						6"	6"	6"	6"	N	R					
0		2.5	SP-SAND (FILL), with gravel, f. sand, f to c. gravel, pg, loam, brown, moist.													
2.5		10.0	Flyash													
	8.0		with paper residuals, sat.													
10.0		15.0	Paper residuals, bluish-gray, sat.													
			E.O.B. 15' bgs													
0		5.0	SP-SAND (FILL), with gravel, tr. cobbles, f. sand, f to c. gravel, pg, loam, brown, moist.													
	1.5		gravelly sand, with cobbles, tr. rebar debris													
5.0		8.0	Flyash													
8.0		15.0	Paper residuals, bluish-gray, moist													
	12.5		v. moist.													
			E.O.B. 15' bgs													

DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____

WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____

COMPLETION DETAILS: _____

NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.

NOTES:
Note: Soil cuttings from augers used to describe lithology.



STRATIGRAPHY LOG (OVERBURDEN)

PAGE 2 OF 4

PROJECT NAME 17th Street Landfill
 PROJECT NUMBER 056393
 CLIENT Weyerhaeuser
 LOCATION Dasego, MI

DRILLING CONTRACTOR EDAC
 DRILLER Shawn
 SURFACE ELEVATION _____
 WEATHER (A.M.) _____
 (P.M.) _____

HOLE DESIGNATION extinction well #1
 DATE/TIME STARTED 7/26/10
 DATE/TIME COMPLETED _____
 DRILLING METHOD Auger - 6 1/4" B.H.
 CRA SUPERVISOR C. Bondy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	SAMPLE DETAILS												GRAIN SIZE	
FROM	TO	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).		SAMPLER	SAMPLING METHOD	PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)						SAMPLER	INTERVAL	P / F ID	CHEMICAL		ANALYSIS
						6"	8"	6"	8"	N	R						
0	0.5	2.5	Flyash														
0.5		3.5	SP-SAND (FILL), with gravel, f. sand, f to c. gravel, pg, l, h, m														
3.5		7.0	CL-CLAY (FILL), with paper residuals, pg, low plast soft, gray, moist to v. moist.														
7.0		10.0	Wood debris														
10.0		11.0	CL-CLAY (FILL), as 3.5-7.0'														
11.0		15.0	Paper residuals, bluish-gray, moist														
			E.O.B. 15' bgs														
0		2.5	SP-SAND (FILL), with gravel, fr. wood debris + cobbles pg, 100%, brown, moist														
	0.5		no wood debris or cobbles														
	1.5		with flyash														
	2.0		no flyash														
2.5		10.0	Flyash														
	8.5		v. moist														
	9.0		Sat.														
NOTES AND COMMENTS			DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____														
			WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____														
COMPLETION DETAILS:			NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL														
			NOTES:														
10.0		15.0	CL-CLAY (FILL), with paper residuals, pg, low plast, soft, gray, moist														
			E.O.B. 15' bgs														



200010-00(002)GN-WA052 OCT 02/2009 (SP-14) REVISION 5

Note: Soil cuttings from augers used to describe lithology.

STRATIGRAPHY LOG (OVERBURDEN)

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PROJECT NAME 17th Street Landfill
 PROJECT NUMBER 056393
 CLIENT Weyerhaeuser
 LOCATION Osage, MN

HOLE DESIGNATION Station well #1
 DATE/TIME STARTED 7/27/10
 DATE/TIME COMPLETED
 DRILLING METHOD Auger - 6" x 4" BH
 CFA SUPERVISOR P. Bondy

DRILLING CONTRACTOR EDAC
 DRILLER Shawn
 SURFACE ELEVATION
 WEATHER (A.M.)
 (P.M.)

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION		SAMPLE DETAILS		PENETRATION		SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)		INTERVAL		GRAIN SIZE	
F	R	O	A	T	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/COMPACTNESS, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTIONS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).	SAMPLE #	SAMPLE LENGTH	6"	6"	6"	6"	6"	6"	GRAIN SIZE
0					5.5 CL-CAY (ELL), with paper residuals, sand + gravel, f. sand, f to c. gravel, pg, low plast, firm, brown, moist									
5.5					7.0 GP-GRAVEL (ELL), with sand, f to c gravel, f. sand, pg, low, brown, moist									
7.0					10.0 CL-CAY (ELL), with paper residuals, pg, low plast, soft, moist to v. moist									
10.0					15.0 Paper residuals, bluish-gray, moist. E.O.B. 15' bgs.									
0					2.5 Flyash									
2.5					4.5 CL-CAY (ELL), with paper residuals, pg, low plast, firm, gray, moist									
4.5					10.0 Flyash									
10.0					11.5 SP-SAND (ELL), with gravel, f. sand, f to c. gravel, pg, low, brown, v. moist									
11.5					14.0 CL-CAY (ELL) as 2.5-4.5'									
14.0					15.0 Paper residuals E.O.B. 15' bgs									

DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____
 WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____
 COMPLETION DETAILS:

NOTES AND COMMENTS
 NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.
 Note: Soil cuttings from augers used to describe lithology.



STRATIGRAPHY LOG (OVERBURDEN)

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PROJECT NAME 12th Street Landfill
PROJECT NUMBER 056393
CLIENT Weaverhauser
LOCATION Atsago, WI

DRILLING CONTRACTOR EDAC
DRILLER Shawn
SURFACE ELEVATION _____
WEATHER (A.M.) _____
(P.M.) _____

HOLE DESIGNATION extraction well #1
DATE/TIME STARTED 7/27/10
DATE/TIME COMPLETED _____
DRILLING METHOD Aug/r - 6" 1/4" BH
CNA SUPERVISOR C. Bondy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	SAMPLE DETAILS										CHEMICAL	GRAIN SIZE
FROM	AT	TO	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).	SAMPLE #	SAMPLING METHOD	PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)						SAMPLER INTERVAL	FID / FID		
						6"	6"	6"	6"	N	R				
0		3.5	Flyash												
3.5		4.0	CL-SANDY CLAY (FILL), with paper residuals, pg, low plast, firm, gray, sat.												
4.0		9.0	SP-SAND (FILL), with clay + paper residuals, pg, loose, brown, v. moist												
9.0		11.0	SP-SAND (FILL), with gravel, f. sand, f to c. gravel, pg, loose, brown, moist												
		11.0	Refusal (feels like concrete) E.O.B. 11' bgs												
0		10.0	Flyash												
	5.0		1' of concrete debris												
10.0		21.0	CL-SANDY CLAY (FILL), f. grained, pg, low plast, firm, gray, v. moist												
	12.0		clay with sand, sat.												
21.0		22.5	Paper residuals, bluish-gray, sat. E.O.B. 22.5' bgs												
			Well Details: 4" PVC stick-up Screen 11-21', sand 9-22.5', chip 0-9'												

Note: When augers were pulled out there was wire wrapped around the last 5' of auger.

DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____
 WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____
 COMPLETION DETAILS: _____
 NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.
 NOTES:
 Note: Soil cuttings from augers used to describe lithologies.

Attempt #7

Attempt #8



STRATIGRAPHY LOG (OVERBURDEN)

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PROJECT NAME 12th Street Landfill
PROJECT NUMBER 096343
CLIENT Weyerhaeuser
LOCATION Otsego, MI

DRILLING CONTRACTOR EDAC
DRILLER Shaun
SURFACE ELEVATION _____
WEATHER (A.M.) _____
(P.M.) _____

HOLE DESIGNATION extraction well #2
DATE/TIME STARTED 7/26/10
DATE/TIME COMPLETED _____
DRILLING METHOD Auger - 6 1/4" BH
CRA SUPERVISOR P. Bondy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	S A M P L E #	S A M P L I N G D	SAMPLE DETAILS						S I N T E R V A L	P I D I D (ppm)	C H E M I C A L	G R A I N S I Z E
F R O M	A T	T O				PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)									
						8"	8"	8"	8"	N	R				
0		3.0	SP-SAND (FILL), with gravel, f. grained, pg, loose, brown, moist.												
3.0		12.0	Fluash												
	8.75		Saturated												
	10.0		With paper residuals												
12.0		15.0	Paper residuals, bluish-gray in color, v. moist												
			E.O.B. 15' bgs												
			Well Details:												
			• 4" PVC, stick up												
			• screen 7-17', sand 5-17', chip 0-5'												
			Note: Soil cuttings from augers used to describe lithology.												
NOTES AND COMMENTS			DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____ WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____ COMPLETION DETAILS: _____ NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL. NOTES: _____												



STRATIGRAPHY LOG (OVERBURDEN)

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PROJECT NAME 12th Street Landfill
 PROJECT NUMBER 056393
 CLIENT Weyerhaeuser
 LOCATION Oshtemo Co. O-Tsego, MI

DRILLING CONTRACTOR EDAC
 DRILLER Shawn
 SURFACE ELEVATION _____
 WEATHER (A.M.) _____
 (P.M.) _____

HOLE DESIGNATION extinction well #3
 DATE/TIME STARTED 7/26/10
 DATE/TIME COMPLETED _____
 DRILLING METHOD Auger - 6 1/4" BH
 CRA SUPERVISOR C. Bondy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	SAMPLE DETAILS											GRAIN SIZE	
FROM	TO	T		S A M P L E #	S A M P L I N G	PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)						S I N T E R V A L	P I D / F I D (ppm)	C H E M I C A L		
						6"	6"	6"	6"	N	R					
0		3.0	SP-SAND (FILL) with gravel, fr cobbles + construction debris, f. sand, f to c. gravel, pg, loose, brown, moist													
	2.0		no cobbles													
3.0		12.0	Flyash													
	5.0		very moist													
	7.0		Saturated													
12.0		15.0	Paper residuals, bluish-gray, sat.													
			E.O.B. 15' bgs													
			Well Details:													
			• 4" PVC, stick up													
			• Screen 6-16", sand 4-16", chip 0-4"													
			Note: Soil cuttings from augers used to describe lithology.													
NOTES AND COMMENTS			DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____													
			WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____													
			COMPLETION DETAILS: _____													
			NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.													
			NOTES:													



STRATIGRAPHY LOG (OVERBURDEN)

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PROJECT NAME 12th Street Landfill
 PROJECT NUMBER 036393
 CLIENT Weyerhaeuser
 LOCATION Atsugi, MI

DRILLING CONTRACTOR EDAC
 DRILLER Shawn
 SURFACE ELEVATION _____
 WEATHER (A.M.) _____
 (P.M.) _____

HOLE DESIGNATION extraction well #4
 DATE/TIME STARTED 7/27/10
 DATE/TIME COMPLETED 8/1/10
 DRILLING METHOD Auger - 6" 1/4" BH
 CEA SUPERVISOR C. Bondy

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	SAMPLE DETAILS										CHEMICAL	ANALYSIS	GRAIN SIZE
FROM	TO	DEPTH	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).	SAMPLE #	SAMPLING METHOD	PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES)						INTERVAL	P/F/D			
						6"	6"	6"	6"	N	R					
0	0.5	2.0	Flyash with paper residuals, tr. cobbles tr. paper residuals													
2.0	7.0	12.0	SP-SAND (FILL), with gravel, f. sand, f to c. gravel, pg, loose, brown, moist. v. moist													
	8.0	12.0	saturated													
		16.0	Paper residuals, bluish-gray, sat.													
			E.O.B. 16' bgs													
			Well Details:													
			- 4" PVC, stick-up													
			- screen 6-16', sand 4-16', chip 0-4'													
			Note: Soil cuttings from augers used to describe lithology.													
NOTES AND COMMENTS			DEPTH OF BOREHOLE CAVING _____	DEPTH OF FIRST GROUNDWATER ENCOUNTER _____		TOPSOIL THICKNESS _____										
			WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____													
COMPLETION DETAILS:																
			NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.													
NOTES:																

